CALIFORNIA
AGRICULTURAL EXTENSION SERVICE

CIRCULAR 44

June, 1930

BANG'S DISEASE

(INFECTIOUS ABORTION)

FRED M. HAYES

Coöperative Extension work in Agriculture and Home Economics, College of Agriculture, University of California, and United States Department of Agriculture coöperating. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. B. H. Crocheron, Director, California Agricultural Extension Service.

UNIVERSITY OF CALIFORNIA
COLLEGE OF AGRICULTURE
BERKELEY, CALIFORNIA

Digitized by the Internet Archive
in 2011 with funding from
University of California, Davis Libraries

http://www.archive.org/details/bangsdiseaseinfe44haye

BANG'S DISEASE IN CATTLE

(INFECTIOUS ABORTION)

FRED M. HAYES[1]

Bang's disease, which is considered by many to be the cause of 90 per cent of abortions in cattle and swine, is the name now applied to a chronic infectious disease which has for many years been referred to as infectious or contagious abortion. Professor Bang, of Copenhagen, was the first to isolate the germ and demonstrate its relation to abortion and premature births of calves; and, since abortion is only one of several symptoms shown, and since many infected cows do not abort, some other name than abortion is to be preferred. The Committee on Abortion of the American Veterinary Medical Association has recommended the use of the term "Bang's disease."

EXTENT AND IMPORTANCE OF THE DISEASE

An infectious type of abortion among cattle has been recorded since very early times, but it was not until 1897 that the actual germ responsible for most of the abortions observed was artificially grown in the laboratory and its ability to produce abortions and other symptoms of the disease demonstrated.

The disease has gradually spread throughout all cattle raising countries. It is world-wide. In the United States, relatively few herds in intensive dairy communities are entirely free from the disease unless definite steps have been taken to prevent its introduction or to eradicate it from the herds. John R. Mohler, Chief of the United States Bureau of Animal Industry, considers that losses from Bang's disease have doubled during the last ten years and that the present loss is conservatively estimated at $50,000,000 per annum.

California dairymen are suffering their proportionate share of these losses to the extent of over $1,000,000 per annum. During 1928–29, the Veterinary Science laboratories of the University of California at Berkeley and Davis tested over 15,000 blood samples of cattle for the presence of Bang's disease. Sixteen per cent of these showed definite positive reactions indicating infection. This figure does not necessarily mean that this percentage of all dairy cattle in

[1] Professor of Veterinary Science and Veterinarian in the Experiment Station.

California are infected, but it is probably a fair average of the amount of infection in herds known to be diseased. Many herds are entirely or comparatively clean, while others show as high as 60 to 70 per cent.

Widespread interest is being shown by cattle owners throughout California and the entire United States in seeking information which may be applied to the diagnosis and control of this important disease. At the present time, nine states and the Hawaiian Islands require a health certificate based upon the blood test. Seven additional states prohibit the entrance of animals known to give a positive reaction to the agglutination test. The live stock sanitary officials of most of the other states are now considering regulations for the control of this infection. In addition, many municipal and county ordinances are in force regulating the sale of infected cattle or of raw milk from them. Public health officials are becoming concerned over the relationship of undulant fever of man[2] to the drinking of milk or to con-

[2] Undulant or Malta fever is a disease of man which, until recently, was thought to be contracted entirely from coming in contact with infected goats or from drinking their raw milk. It has been recognized as a disease of the human family for many years and was first discovered and studied on the Isle of Malta and in places bordering the Mediterranean Sea. It is characterized by long duration, by sweating, joint pains, undulating type of fever and weakness, with a low mortality. It has often been mistaken for mild typhoid, malaria, and miliary tuberculosis.

In 1886, David Bruce, a surgeon in the British army, isolated the specific germ from a fatal case of the disease in man and called the microbe *Micrococcus melitensis*. It is now called, after Bruce, *Brucella melitensis*. The British Mediterranean Fever Commission established the relationship of the disease in goats to that in man. The disease in goats is characterized by a high percentage of abortions with the production of "carriers" and organisms in the milk such as occur in cattle affected with Bang's disease. Malta fever in goats is probably important at present only in the States of Arizona, Texas, and New Mexico.

In 1897, Bang described the bacillus which is the cause of what has been known as infectious abortion. He named it *Bacillus abortus*, which name was later changed to *Brucella abortus*. For twenty years, or until 1918, the close relationship between *Micrococcus melitensis* and *Brucella abortus* was unknown. It remained for Miss Alice Evans of the United States Public Health Service, to point out that the organism causing undulant fever in man and goats, and infectious abortion of cattle and hogs could not be readily distinguished. There are now three varieties of the germ recognized as, caprine, bovine, and porcine. These types are classified largely upon the basis of the host from which the organism is obtained, i.e., goat, cow, and hog, but to some extent also upon slight differences in biological characters. The most common source of undulant fever in man has been the infected goat.

Because of the added knowledge of the close relationship between the germs of the disease in man and animals, a closer study has been made of the possibilities of infection of human beings from contact with infected animals other than goats. The results of these studies throughout the world have given unmistakable evidence that man may contract undulant fever at least from infected cattle and hogs. The number of reported human cases is growing every day, due not necessarily to any actual increase of the disease, but probably to a more accurate diagnosis by physicians. According to A. V. Hardy, of the University of Iowa, ten cases of undulant fever were reported in the United States, exclusive of Texas, Arizona, and New Mexico, in 1924 and 1925. During 1928, and the first five

tact with infected animals. Some of these officials are demanding the pasteurization of all milk or the eradication of the disease from the herds. Medical milk commissions having control over the production of certified milk already require that the milk come from animals negative to the test.

From the statistical studies that have been made upon production in infected and non-infected dairy cattle, it is estimated that the clean or non-infected cattle are from 15 to 25 per cent more efficient. An infected herd is, therefore, not an economical unit to maintain.

All these facts should emphasize the importance and value to cattle owners of determining, as soon as possible, whether or not the disease exists in their herds and of adopting the recognized procedures to prevent and eradicate it. The following pages will be devoted to a discussion of some of the most important facts concerning the nature and characteristics of Bang's disease together with suggestions for its control and eradication.

CAUSE OF BANG'S DISEASE

The actual cause of Bang's disease is a specific germ known as *Brucella abortus*. Since the discovery by Professor Bang, in 1897, that this particular germ was capable of producing abortions in cattle, many studies have been made regarding it, and there is no longer any doubt but that this germ is largely responsible for the losses due to abortion and retained afterbirth.

There are other causes for abortions and sterility in cattle, but these are responsible for relatively few cases. Other germs have been

months of 1929, Hardy states that more than a thousand cases were diagnosed in forty-two states.

The mode of infection in man is still in the problematical state. It is generally believed that exclusive of the goat, the hog strain is more virulent for man than that from cattle. It is stated by some investigators that since a considerable percentage of cows affected with Bang's disease expel the organisms in the milk, that milk is the logical source of infection in the human. However, a study of the histories of human cases does not incriminate raw milk to any greater extent than other means of contact. Furthermore, the striking evidence is noted that children, the largest users of milk, are rarely affected. It is a disease of adult age, confined mostly to males who come in contact with animals. Farmers, butchers, and meat packing house employees are frequently affected. On the other hand, there have been a considerable number of cases among individuals who have had no history of any immediate or recent contact with animals. A certain amount of unfortunate and uncalled for publicity has been given to the supposed danger of drinking raw milk. There is no cause for excitement. According to a health news bulletin issued by the United States Public Health Service on December 28, 1929, undulant fever is not so prevalent in the United States as to constitute a major health problem. But the facts must be faced—there is a disease of man, whether new or old does not matter, called undulant fever, that may be contracted accidentally and to a limited extend from infected animals besides the goat. Therefore the necessary precautions should be taken when dealing with such diseased animals.

isolated following outbreaks of abortion, but fortunately these other germs do not remain long in a herd and do not cause persistence of the disease year after year. Abortions may also be caused by accidents, as in the case of cows slipping, falling, or being gored, but these are exceptional occurrences. In certain districts, mineral deficiencies may be responsible for actual abortions or lessened fertility. Statements have been made by breeders that mistletoe and acorns may produce abortion, but there is no experimental evidence to indicate that this is a fact. Moldy forage or grains have been said to be a cause, but this is also exceedingly rare.

HOW THE DISEASE STARTS AND SPREADS

When the specific germs enter the body, they have a tendency to localize or settle in certain parts. These parts are principally the pregnant uterus, the lactating udder in the cow, and the generative organs of the bull. Evidence indicates that other parts of the body are comparatively free of the germs soon after they are taken into the system. In the case of calves exposed to the infection by drinking contaminated milk, the germs may temporarily inhabit the lymphatic glands along the digestive tract, but they disappear from these tissues in six weeks or two months after the calves are removed from the infected environment. It is also characteristic of the germs to remain more or less permanently in the udders of a certain percentage of infected cows. Such animals are known as "carriers" and may be responsible for the spread of the disease in the herd. After the womb is emptied by an abortion or by even a normal calving in an infected cow, the organ tends to free itself of the germs, and they are not again found until pregnancy is re-established.

The organisms are expelled from the body principally by the genital discharges accompanying an abortion and from about 25 per cent of infected cows which calve normally. The second important channel through which the germs may leave the body is through the milk from an infected udder. From 25 to 60 per cent of infected cows may more or less constantly expel the germs through the milk. Infected bulls (see figures 1 and 2) may also spread the germs by genital discharges, infected semen, and by the urine. Another means, though probably less important, is through the manure of calves that have been drinking contaminated milk. The germs in the milk taken by the calf are not all killed in the digestive tract and may pass out alive in the manure and contaminate the food and water of mature animals.

The germs are taken into the body mainly through the digestive tract when animals eat feed or drink water containing the organisms that have been discharged from the body in the various ways just described. Formerly the view was held that the disease was spread

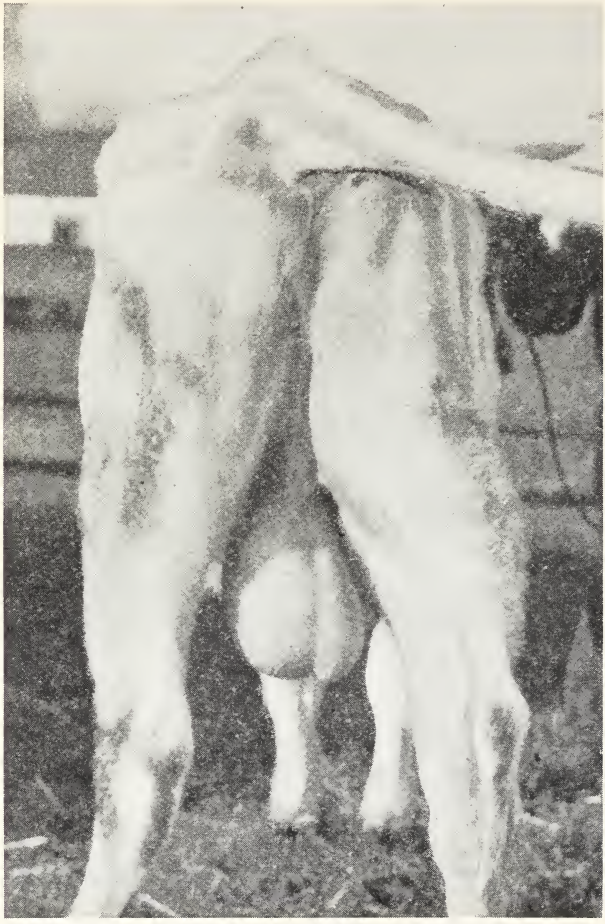

Fig. 1.—Bulls affected with Bang's disease sometimes show swollen and abscessed testicles.

by entrance of the germs directly into the genital organs by breeding to infected bulls, or by bulls serving infected cows that had genital discharges containing the germs, and thus transfering these germs mechanically to healthy cows. It is now known that these are not important means of dissemination of the contagion and that if animals could be kept from taking into their mouths any contaminated food or water, there would be little spread of Bang's disease.

The period of incubation, which is the time between the entrance of the germs into the body and signs of infection in the animal, varies somewhat in different individuals. It is dependent upon the number of organisms ingested, their virulence, and the natural resistance to them. In some cases, evidences of infection as shown by a blood test may appear as early as two or three weeks after exposure to the disease, but on the other hand may be delayed longer.

Susceptibility is greatest in heifers of breeding age and in those carrying their first calves. However, age is not an important protection against the disease. Most cows and bulls of any age may become

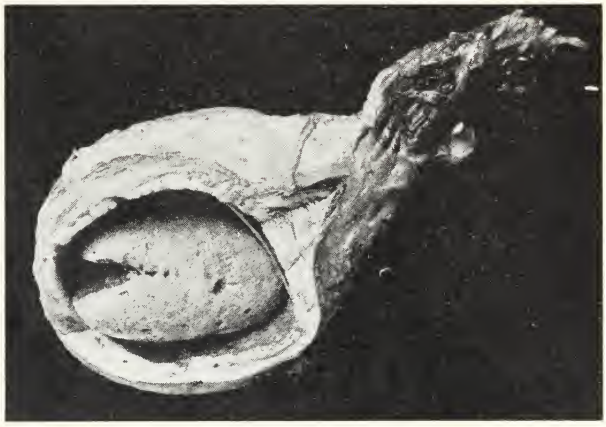

Fig. 2.—Appearance of abscessed testicle from bull shown in figure 1.

affected if exposed to sufficient germs. In herds where the disease has existed for some time, the older cows may show a slightly higher degree of resistance than the young heifers so far as actual abortions are concerned. Some animals seem to show a natural resistance and may remain uninfected many years in an infected herd. As has been previously stated, calves do not become permanently diseased even though they are exposed to heavy doses of the germs during their milk drinking period. However, there is no immunity conferred to such calves, and, if they are exposed to the infection at the breeding age, they prove highly susceptible.

SYMPTOMS IN THE HERD

In the herd, Bang's disease is characterized by not only the abortion or premature birth of the calf, but also by retained after births, sterility, and udder disturbances. Full time or nearly full time calves are often born weak and die soon, or have a poor start in life when

delivered by an infected mother. It is further characterized by periods of calm for several years in some herds without marked evidences of its presence, which may be followed by a "storm" of abortions involving the majority of the animals, and with a corresponding increase in retained afterbirths and sterility. Generally, there is a constant drain on the efficiency of the herd by lessened calf and milk production, with a gradual spread of the disease until the majority of the animals are affected. The infection may spread rapidly or slowly, but the spread is certain, unless measures are taken to control it.

In the individual cow, symptoms are not marked by physical signs that can be depended upon to be diagnostic of the specific infection. When abortion occurs as a symptom, the physical signs are not greatly different from those that occur at a normal calving except that it occurs before the end of gestation. Abortions may take place at any stage of pregnancy, and the period is no indication of whether or not they are due to Bang's disease. The majority of cows, especially heifers, probably abort somewhere between the third and seventh month. Some cows abort without noticeable signs and before the fetus is large enough to be easily seen. A positive blood reaction to the agglutination test is the surest symptom of infection, because many infected cows never abort and relatively few abort the second time.

DIAGNOSIS BY THE AGGLUTINATION TEST

The symptoms described in the preceding paragraphs are suggestive of the presence of Bang's disease, but the individual cows that are infected cannot be identified in a short time nor without a great amount of laboratory work except through an examination of their blood by means of the agglutination test. This test is based upon the fact that infected animals have substances in their blood known as agglutinins, which are the products formed in the body as a reaction against the germs. A quality peculiar to agglutinins is that when they are brought in contact with the particular germ responsible for their production, they have a tendency to clump or agglutinate the germs. This phenomenon can be observed either on a glass plate or in a test tube (see figures 3 and 4), but the usual procedure in the laboratories of the Division of Veterinary Science of the University of California is to mix some of the cow's blood serum with a salt solution suspension of the germs in test tubes. This suspension is called the antigen and has a standard degree of cloudiness due to the suspended abortion

germs. Except for special tests, four dilutions are made of serum in antigen in the routine testing of the blood of each animal in proportions of 1–25, 1–50, 1–100, and 1–200. The tubes are placed in an incubator for several hours or overnight and examined at the twenty-fourth and forty-eighth hours after being set up for changes in the degree of original cloudiness and for signs of settling of the germs to the bottoms of the tubes. The forty-eighth hour reading constitutes the final report. Complete clearing of the fluid with settling of the

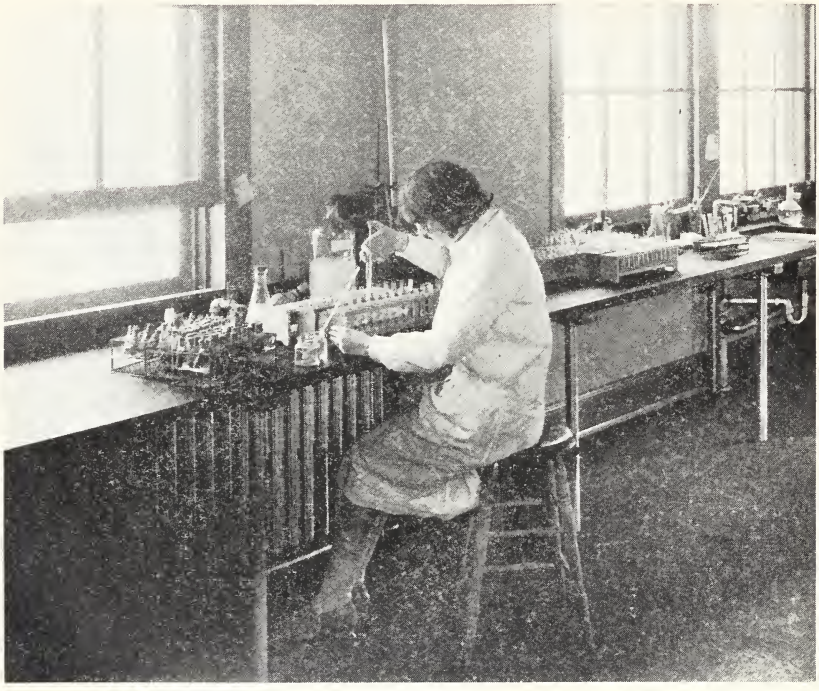

Fig. 3.—Testing blood samples by the tube method agglutination test.

organisms in any of the tubes is designated by the sign + (plus). Partial clearing is indicated by the signs ± or ∓ (plus-minus or minus-plus), depending upon the extent of the clearing. No change in cloudiness of the tubes is recorded as — (minus).

The next procedure is to determine the infected, non-infected, or doubtful cows, or the positive, negative, or suspicious reactions. Those animals whose four test tubes retain their original cloudiness or show only faint signs of clearing in the first tube are negative (N) or non-infected. Those showing complete clearing in the first, or first and second tubes only, are suspicious (S). Those showing complete clear-

ing in the first two tubes and *any* clearing in the third tube, are positive (P) or infected. A strong reaction is one showing a plus (+) in all four tubes.

The following are some types of tube reactions which occur, together with the diagnostic interpretation placed upon them by the Veterinary Science laboratories of the University:

+ + + + = P	+ + — — = S	+ ± ∓ — = S
+ + + ± = P	+ ± — — = S	± ∓ — — = S
+ + ± — = P	+ ∓ — — = S	± — — — = N
+ + ∓ — = P	+ — — — = S	∓ — — — = N
+ ± ± — = P		— — — — = N

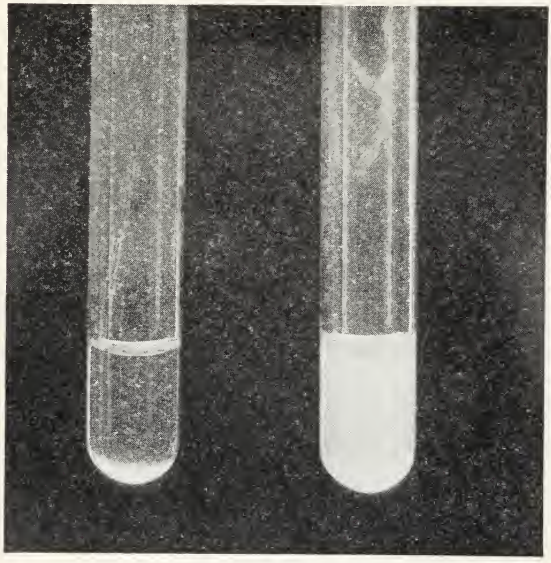

Fig. 4.—A positive (left) and negative (right) reaction to the tube or slow agglutination test. (From Bul. 486.)

The agglutination test is a useful and satisfactory method of detecting the cows that are, or have been, affected by Bang's disease. It however does not give any positive indication whether or not a cow has or will abort, since many cows may resist this effect permanently or temporarily through one or more gestation periods. It is exceedingly rare for an infected cow to fail to give some signs of a blood test reaction. Positive reacting animals may recover from the disease and become non-reactors, but this happens only in a small percentage of cases and usually requires too much time to be given practical consideration. Therefore, for practical control measures, a reactor is

considered always a reactor. The great majority continue to be positive reactors for several years—indicating that they are chronically affected. Again it has been noted that some cows show a fluctuation in the degree of the reaction, being on the border line between suspicious and positive at different times. Reactions in infected cows may be negative in rare instances if the blood sample is taken at the time the cow aborts or calves normally. It is therefore advisable to re-test animals from four to eight weeks after calving. The test is unreliable for many months after cows have been vaccinated with live or dead germs, especially after the use of the former.

The value of the agglutination test is its ability (1) to indicate the presence of the disease in the herd, (2) to determine whether or not abortions are due to *Brucella abortus*, (3) to pick out infected cows that may be spreading the disease though calving normally, and (4) provided that proper control measures are applied after the test shows presence of the disease, the agglutination test is the basis for eradication of Bang's disease from a herd.

BLOOD TESTING SERVICE

A limited amount of agglutination testing is also being done at other bacteriology laboratories connected with public institutions in various parts of the state. The Division of Veterinary Science of the University of California at Berkeley and Davis has been testing blood samples for cattle and swine owners for several years, and will continue to do so under certain conditions until other laboratories, state or private, can take over the work. It probably will become necessary in the near future to make a charge to provide the necessary additional assistance and equipment to give adequate help to those who wish samples tested.

The bottles and corks are not furnished by the Division of Veterinary Science and will not be returned to the shipper except under exceptional circumstances. The bottles are usually destroyed because it costs more to wash and prepare them for use again than it does to purchase new bottles.

The purpose of the testing service by the University is to encourage the more general use of the agglutination test as an aid to cattle and swine owners in the control and eradication of Bang's disease. The tests are made upon the assumption that some kind of effort will be made to control the disease and that if the reacting animals are disposed of for purposes other than slaughter for food, the purchaser

shall be informed that they are reactors, so that he will not unsuspectingly place them in a herd that is free, or comparatively free, of the disease. Failure to give the proper information to purchasers is an unscrupulous act, and has resulted in considerable spread of the disease and unfortunate results.

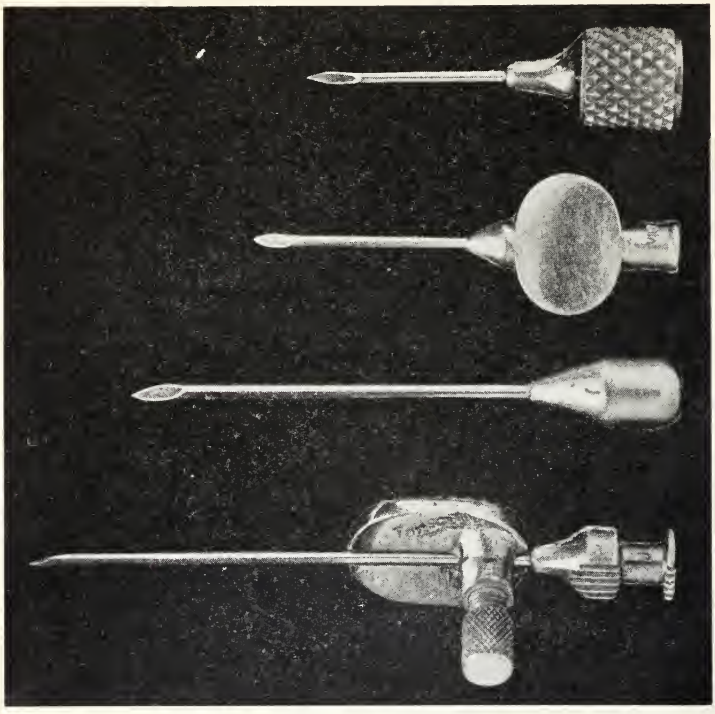

Fig. 5.—Types of needles used for bleeding from the jugular vein.

COLLECTING AND SHIPPING BLOOD SAMPLES

It is advisable to employ a veterinarian to attend to the drawing and shipping of the blood and to have his advice in matters relating to the control of the disease and subsequent blood testing. However, there are many districts in California where veterinarians are not readily available, and it may be necessary for livestock owners themselves to collect and ship the blood.

The quickest and most satisfactory method of drawing blood is from the jugular vein of the cow by means of a 16-gauge hypodermic needle one to one and one-half inches long (see figure 5). Several of these needles should be available and kept in a pan containing 25 per

cent wood or denatured alcohol, or some hypochlorite type of disinfectant when a large number of animals are to be bled. While one is being used for bleeding, the others should be lying in the disinfecting fluid. The animals are best restrained in stanchions or tied to a fence with their heads drawn up and to the side by means of a strong halter. A ¾-inch rope with a ring in one end may be thrown around the cow's neck at about the middle part and drawn up tightly, which will cause the jugular vein to stand out prominently between the rope and the head. In this position, a sharp hypodermic needle may be

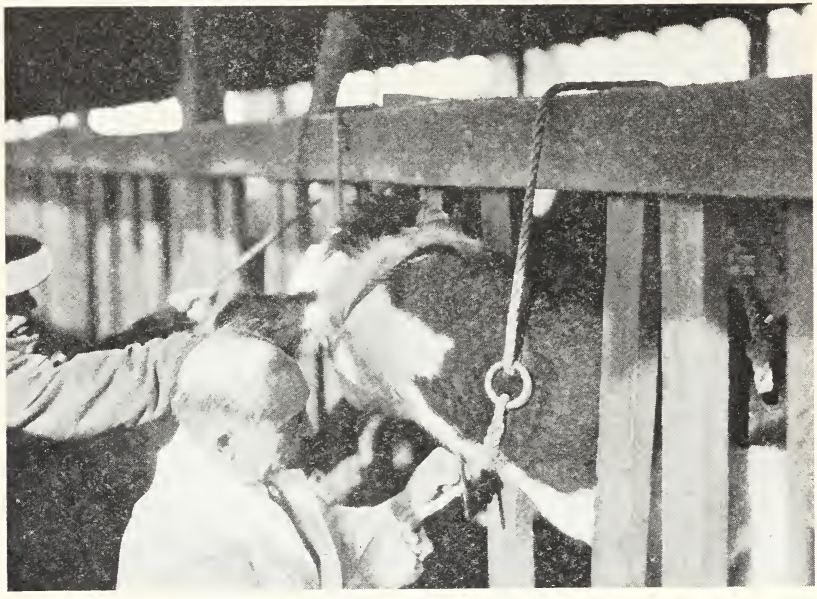

Fig. 6.—Bleeding a cow from the jugular vein.

inserted into the vein midway between the rope and the jaw, and the required amount of blood caught in the bottle (see figure 6).

A slower, but simpler method of collecting blood is that of taking it from one of the veins on the outside of the ear (see figure 7). In long-haired ears, it may be necessary to clip some of the hair with a pair of scissors in order to see one of the veins. After a vein is located, it may be punctured with the sharp point of a knife. Blood will drop from the punctured vein off the edge of the ear and can be caught in a bottle. In thick-necked cows and bulls, jugular bleeding is often very difficult and the ear method can be conveniently employed. Should these methods of collecting the blood fail in any individual animal, the underside of the lower third of the tail may be cut into

with a sharp knife for the purpose of obtaining the blood. Bleeding by the ear (see figure 8) or by cutting off a small piece of the tail is the most satisfactory for swine.

Fig. 7.—Bleeding a cow from an ear vein.

Fig. 8.—Bleeding a hog from an ear vein.

The preferred type and size of bottle is a small test tube about 4 x ½ inches, or a homeopathic vial holding two or three drams (teaspoonfuls). These bottles or tubes need be filled only about one-half full of blood. They are inexpensive, and including corks,

can be purchased from some of the wholesale drug companies for not more than two cents each in gross lots. The bottles need not be sterilized, but should be clean, dry, and preferably new. Each should be carefully corked and the number of the cow written with an indelible pencil on the cork and also on the label attached to the bottle. Plenty of packing material such as waste paper, sawdust, or cotton, should be included in the packing so that the bottles will reach the laboratory without breakage. During the summer months it is sometimes difficult to ship the blood from the warm section of the interior valleys without spoilage occurring. Under most circumstances in the warm months, it is advisable to place the blood in a refrigerator for several hours or overnight as soon as possible after the samples are collected. They should never be exposed to direct sunlight for any considerable period, since sun may dissolve the coloring from the corpuscles and cause the serum to become red, which interferes with the testing. If these precautions are observed and the packing operation is well executed, the samples will reach the laboratory in a satisfactory condition. Much extra work is caused to those concerned with the drawing and testing of the samples if they do not arrive at the laboratory in good condition.

"CURES" FOR BANG'S DISEASE

There is no such thing at present as a cure for Bang's disease, nor is there any satisfactory means of preventing it by the use of drugs and vaccines. Many drugs have been recommended and many "abortion cures" have acquired a reputation through advertising, but none, so far, have shown satisfactory results in well controlled experiments with them. Experiments at the University of California and at Michigan State College have shown that intravenous injections of antiseptics such as acriflavine and mercurochrome are valueless. Vaccines are also in this class, with the exception of the live-abortion vaccine which, experimentally, will reduce the number of abortions, but because of its many disadvantages, is not to be recommended. In fact, the Committee on Bang's Disease of the United States Live Stock Sanitary Association has recently recommended that the distribution of this type of vaccine be prohibited. The live vaccine, which is virulent or may become virulent, should not be used in herds producing milk for consumption in the raw state, because of the possible danger that some strains of germs used in the vaccine may be capable of producing undulant fever in man.

The reputation gained by some of the nationally advertised remedies is undeserved and exists mainly in the minds of the persons exploiting the products. Certain "sure cures" and "preventives" which gained prominence during the past twenty years are no longer heard of, while new ones are springing up frequently even nowadays. By means of advertising and salesmanship, thousands of dollars have been taken from the pockets of the dairymen for worthless mixtures, one of which consisted of brown sugar and bran.

CONTROL AND ERADICATION

The only successful method of controlling and eradicating infectious abortion disease is based upon the blood test. Without a knowledge as to which animals are infected as shown by the test, the livestock owner is helpless to do more than delay the spread of the disease. Isolation of aborting cows and the practice of hygienic operations in connection with aborters, such as disposal of the fetus and afterbirth, selling of aborters, and the disinfection of the premises are useful procedures, but so far as controlling Bang's disease, they serve only to retard its progress and not to eradicate it from the herd. Certain recognized plans for freeing a herd of Bang's disease have been successful and have stood the test of sufficient time to insure their practicability and economic value. The adoption of any of them, and the details of each, is dependent upon the percentage of animals that react to the blood test, the physical equipment for handling them; and their final success upon intelligent supervision and attention to details based upon a knowledge of the characteristics of the disease.

The Moderately Infected Herd.—When the percentage of reactors is low (not more than 15 per cent) it is usually the most economic practice to dispose of all reactors for food or to a known infected herd that is operating for whatever milk and healthy calves may be produced under the handicap of infection. Fortunately, beef has brought a good price during the last two or three years and many dairymen have taken advantage of the good market and sold abortion-infected dairy cows at a fair price. Meat from reactors is wholesome as food. Most dairymen who have had experience with this disease think it better to take the immediate loss than to keep animals separated, unless there is some special reason as in purebred herds where it may be desirable to retain and separate valuable breeding cows for their offspring.

Blood tests should be made every two months as long as reactors are found. After the entire herd of all animals of breeding age has

given one or two negative tests, the interval of testing may be lengthened to every three or four months. There is no harm, and there may be value in testing more frequently, but there is no need for testing the entire herd oftener than once a month.

As an example of results that may be expected from testing and immediately removing animals from a herd moderately infected, the following table of a herd is included which has been under the supervision of the Division of Veterinary Science of the University in cooperation with the Division of Animal Industry, State Department of Agriculture.

TABLE 1

CONTROL OF BANG'S DISEASE IN THE NAPA STATE HOSPITAL HERD; RESULTS FROM REPEATED AGGLUTINATION TESTS AND SEGREGATION OF REACTORS

Date	Total animals tested	Reacted	Per cent
June 30, 1924	160	22	13.7
Sept. 13, 1924	149	6	4.6
Oct. 30, 1924	138	1	0.7
Jan. 13, 1925	130	2	1.5
Mar. 13, 1925	149	1	0.66
May 5, 1925	124	0	
July 8, 1925	174	0	
Sept. 29, 1925	170	0	
Dec. 15, 1925	174	0	
Mar. 10, 1926	175	0	
June 15, 1926	176	1	0.56*
Dec. 7, 1926	159	1	0.62*
Apr. 21, 1927	184	0	
Dec. 21, 1928	170	0	
Nov. 20, 1928	162	0	
Sept. 23, 1929	168	0	

* The animals which reacted June 15 and Dec. 7, 1926, had probably been in contact with some of in the inadequately isolated reacting cows. At that time, only five reactors were still retained on the place. By the end of 1927, all of these had been removed.

Separating the Negative and Positive Reactors.—If the percentage of reactors to the agglutination test is relatively high and for various reasons it is not feasible to dispose of the reactors, the animals may be divided into negative and positive groups for the purpose of stopping the spread of the disease and raising healthy calves from the infected herd to eventually build up the negative herd to its original size.

The infected animals that are to make up the positive herd should be closely culled so that only the best milkers and calf producers are included. Any that can be disposed of for beef without great loss

should be handled in this way so that this unit will not be too large and can be kept at some profit. It will usually be found that the positive herd will be gradually reduced from one cause and another until it is cheaper to sell what few are left than to maintain the separate herd.

The question of how complete the separation of two groups should be is a matter for consideration. Numerous attempts have been made to control abortion disease on the segregation plan by keeping the reactors and non-reactors on opposite sides of the milking barn in corrals and on opposite sides of the barn at milking time. In practically every instance, this method has failed to entirely prevent the spread of the disease. The best results are obtained when the animals are at least a quarter of a mile apart with separate equipment and caretakers. Equipment is the most important factor to duplicate. The same herdsman or milker, if he understands the sources of infection and the manner of spread, can avoid disseminating the disease if there is no transfer of equipment and feed between the two groups. Equipment is also understood to mean shoes or boots and overalls. These should be kept at the quarters of the positive reacting animals. One man may make a complete success of this plan with only a wire-tight alley between the groups, whereas another may fail when the distance between the herds is greater, because of lack of attention to details.

The raising of calves is one of the most important features of such a plan for handling Bang's disease. It is fundamental to the creation of a herd free from abortion and can also be made the basis for a tuberculosis-free herd as well. The methods of doing these things are fully discussed in Extension Circular 33.[3] So far as Bang's disease is concerned, it is only necessary to keep the calves in an abortion-free environment after they are from six to eight months of age, or to remove them at weaning time from the infected quarters to clean, separate pastures or barns until they freshen and are ready, if their blood test is negative, to be placed in the negative herd. When tuberculosis is a factor, the calves must be removed from their tuberculous mothers or associates within forty-eight hours after birth, and fed upon pasturized milk or some other feed that is safe.

Blood tests should be made upon the negative herd, including every animal near the breeding age, every two months from the time

[3] California Agricultural Extension Service Cir. 33, "Rearing Dairy Heifers Free from Tuberculosis and Abortion Disease," will be sent free upon request to the Director of the Agricultural Experiment Station, University of California, Berkeley.

the separate herds are established until a completely negative test is obtained. After this is accomplished, the interval may be extended to three or four months. Calves born in the infected herd should never be added to the clean herd until they give a negative test and particular attention should be paid to testing them at the breeding age.

The extra cost of putting such a plan into operation is immediate, but the maintenance of abortion-infected cattle over a period of years is a constant and prolonged expense, which is sure to exceed any immediate cost necessary to lay the foundation for a future profitable business.

Keeping the Negative and Positive Reactors Together.—If land, buildings, equipment, and help are positively not available for the operation of two herds, a single infected unit can be maintained by employing certain sanitary measures while healthy heifers are being grown to replace the old infected herd whenever this becomes possible. A blood test should be applied at two or three month intervals in order to identify all the new reactors. All aborted fetuses and the afterbirth of all calvings should be carefully disposed of so as not to bring them in contact with any of the non-reactors or contaminate any feed or premises of the non-infected. Aborting and calving cows should be kept separate until all discharges have stopped and then the rear third of the animal, including especially the tail, udder, and genitals, should be thoroughly washed with warm disinfectant and soap before turning back with the balance of the herd. Calving or aborting time is the dangerous time for spread of the disease by the infected cows. Maternity stalls that can be thoroughly disinfected are useful to provide isolation for reactors that calve normally or abort.

If it is necessary to add cows to this type of herd, it is better to buy known reactors or aborters than negative cows, provided their breeding efficiency seems to be satisfactory because negative cows may acquire the disease after being introduced into the infected herd.

This plan has only two virtues. One, to delay the progress of the disease in the herd so that when the time arrives when reactors can be sold, there will be a few non-reactors left to form a nucleus for a clean herd. Second, to keep a large enough herd together for milk production and calf raising to make it worth while to operate at all.

Experience has shown, however, that despite the sanitary precautions which may be followed as suggested, the disease will continue to spread to some degree. One herd under the observation of the Division of Veterinary Science showed an increase of from 17 per cent to 40 per cent in four years when only these sanitary procedures were

employed to control the disease. Some herds have shown a greater spread, and others less. Since the herd in question was divided into negative and positive reactors, and the positive animals moved about one-quarter of a mile away and operated as a separate herd, the negative herd has shown only one reactor in two years. This is an example of what may be accomplished in a badly infected herd by complete separation.

The Clean Herd.—The cattle owner who is fortunate enough to have a herd free from Bang's disease or who has gone through a costly experience in freeing a herd of the disease must take every precaution to prevent its introduction and be ever on the alert for evidences of its presence. In order to protect a negative herd, the following recommendations are suggested for general guidance:

(*a*). Blood tests should be made on all animals of breeding age at least every six months and more frequently if there is any suspicion of the disease.

(*b*). Every abortion and retained afterbirth, and these may occur in a negative herd, should be handled in the same manner as if they were due to a specific infection. Each case of this nature should be proved negative to Bang's disease by means of the blood test before the animals are allowed to return to the general herd. A second test in about six weeks is always in order on such animals as an extra safeguard.

(*c*). Raise the heifer calves to replenish the herd as cows are needed, instead of buying on the outside. Surplus pregnant heifers from a herd known to be free of Bang's diseaes and tuberculosis will find a ready sale at good prices.

(*d*). When mature cows are added to the herd, the safest kind are first-calf heifers from a negative herd. All newly purchased animals, including bulls, should give a negative test at time of purchase, should be in quarantine for from four to six weeks, and be tested again before it is considered safe to keep them in the herd.

(*e*). No exchange of animals for breeding purposes, except between negative herds, should be made.

(*f*). Great care must be exercised to prevent infection when animals are being shown at state and county fairs.

(*g*). No milk except that thoroughly pasteurized should be brought onto the premises for any purpose.

(*h*). Do not assist neighbors in caring for their aborting cows and cows with retained afterbirths.

DISINFECTING THE PREMISES[4]

It is impossible to give any definite information as to how long the germs of Bang's disease will remain alive outside the body of the animals or how long certain barns, corrals, or pastures will remain contaminated. Many factors are concerned and these factors vary with differing barn and corral conditions. The premises occupied by some herds are often saturated with the organisms because of a great number of abortions and of neglect in properly segregating the aborters and cleaning and disinfecting after them. In other infected herds, proper handling will have reduced the amount of contamination to a minimum. Therefore no specific rules of disinfecting procedure can be laid down nor can any time be set that will always insure an entirely safe environment for healthy cows. In cool, shady, moist places, the germs may remain alive in manure and afterbirths for several months. Sunlight and drying destroy them in a few days on the surface of contaminated materials.

Cleaning is more important than disinfection in destroying almost any infectious material that may contaminate the habitat of animals. Too much reliance is often placed upon the application of disinfectants without previous cleansing of the parts to be disinfected. The following suggestions are offered as general procedures in cleaning and disinfecting to prevent a recurrence of an infectious malady such as Bang's disease:

Disinfecting the Barn.—(*a*). Sweep down all movable dirt, dust, cobwebs, etc., from the ceiling, walls, and feed troughs into a pile that can be saturated with disinfectant.

(*b*). With hot strong lye water scrub the walls thoroughly inside and out using strong heavy brushes. Treat similarly the stanchions, feed troughs and floors. Pay particular attention to cracks in the floor and feed troughs. Long-handled brushes are desirable to protect the hands against the lye solution.

(*c*). Spray a generous quantity of disinfectant on all parts that have been scrubbed and keep animals away until the excess disinfectant has evaporated or soaked into the wooden structures.

(*d*). Expose the inside of the barn to as much sunlight as possible.

[4] For a description of methods of disinfection, write to the Office of Information, United States Department of Agriculture, Washington, D. C., for Farmers' Bulletin 954.

Disinfecting the Corral.—(*a*). Fences, feed racks, and watering troughs should receive the same treatment as the inside of the barn.

(*b*). Manure should be removed down to the original soil. It should either be piled away from the animals or scattered upon fields that will be free of them for at least two or three months.

KIND AND STRENGTH OF DISINFECTANTS

The best general disinfectant for the above purposes is a saponified cresol solution. Compound Solution of Cresol is the official name for such a fluid, but the product is marketed by wholesale drug firms under various trade names. This germicide should contain at least 50 per cent pure cresol or cresylic acid. One part of the cresol compound to 30 parts of water is the correct proportion. This disinfectant has a slight disadvantage when used around dairy barns because of the possibility of milk absorbing the odor. Barns should be opened and well aired before milking.

Bichloride of mercury (corrosive sublimate) is another disinfectant that may be used, but its only advantage is that it is odorless. On the other hand it is *highly poisonous* to man and all animals, and great care should be exercised that none of it is taken into the mouth. The proper strength of this drug as a disinfecting agent is one part to 1000 parts of water. It is marketed in tablet form with directions for making the desired strength.

WHAT IS BEING DONE TO CONTROL BANG'S DISEASE

At the present time there are no state or national laws compelling a livestock owner to rid his herd of Bang's disease. Some states have laws prohibiting the entrance of abortion-infected cattle into the state. Producers of certified milk are required to furnish such milk from cows known to be non-reactors to the agglutination test. There is strong evidence that this regulation may soon become general in so far as raw milk supplied to the larger cities is concerned. Except for these local regulations here and there throughout the United States, the control and eradication measures are on a purely voluntary basis. A number of the states aid the dairyman by means of a cooperative plan similar to the accredited herd plan for the control of tuberculosis. Pennsylvania was one of the first states to adopt such a plan with reference to Bang's disease and the method of controlling it is known as the "Pennsylvania Plan." Any livestock

owner in Pennsylvania may voluntarily place his herd under the supervision of the state Department of Agriculture, but he must comply with certain requirements, all intended to eradicate abortion from the herd and protect it from re-infection through repeated blood testing and elimination of reactors. When no evidence of Bang's disease has been shown and no reactors found for a period of one year, the herd is designated as an abortion-free approved herd, and the owner given a certificate good for one year unless revoked. A recent report from Pennsylvania shows about 50,000 blood tests were made in 1928–29 without solicitation. Certificates have been granted to about 270 herds. Approximately 1000 herds have given one test with no reactors, with nearly 3000 herds in the process of becoming certified Bang's-disease-free.

In order to demonstrate the value and feasibility of the control and repression of Bang's disease in California by some of the plans already suggested, demonstration herds are being established voluntarily by many dairymen through the assistance of an Extension Veterinarian employed by the University, the local veterinarian, and the Farm Advisor. There is no other plan in operation in California at present but great good can be accomplished towards the eradication of this vital disease that strikes at the foundation of the cattle-breeding and dairy business, if livestock owners will seek, and apply, the facts which are known to be useful in its control.